

REMARKS

Claims 8-11, 14, 16-26 and 28-44 are pending and stand ready for further action on the merits. Claims 1-7, 12, 13, 15 and 27 have been cancelled.

Independent claims 8, 23, 29, 35 and 39 have been amended to more clearly define that the diffusion source includes an element which converts the substrate from a p or n type conductor into the opposite of n or p type conductor.

Claim 8 has been amended to recite that the diffusion source includes at least one of silicon and carbon and comprises at least one of Cl, Br, I or alloy thereof. Support for this amendment can be found in cancelled claims 12, 13 and 15.

Claims 16, 18, 20, 22 and 28 have been amended for clarity.

Claims 23 and 35 have been amended to recite that before the diffusion source is disposed, the front surface of the substrate is chemically etched. Support for this amendment can be found in cancelled claim 27.

Support for new claim 43 can be found in claim 18.

Support for new claim 44 can be found in claim 20.

No new matter has been added by way of the above-amendment.

The following sections correspond to the sections of the outstanding Office Action.

Drawings

The Examiner objects to the drawings for not showing the claimed feature of electrodes formed on the front and rear of the substrate. In response, Applicants enclose herewith a replacement sheet of the first sheet of drawings. In the replacement sheet, Figure 2 has been amended to clearly show the electrodes formed on the front and rear of the substrate as requested by the Examiner. The Examiner will note that the amended Figure 2 is similar to Figure 1 of Marine et al. (U.S. 4,295,148) cited by the Examiner. Accordingly, withdrawal of the objection is respectfully requested.

Claim Objections

With regard to claim 6, the Examiner's objection to this claim is rendered moot by the cancellation of claim 6.

The Examiner objects to claim 22 under 37 C.F.R. §1.75(c) as being in improper form because a multiple dependent claim cannot depend from any other multiple dependent claim. Applicants respectfully submit that the Examiner's determination that claim 22 depends from another multiple dependent claim is incorrect. Currently, claim 22 depends from any one of claims 8-12, 14 and 16-21. None of these claims are multiple dependent claims or depend from multiple dependent claims. Accordingly, withdrawal of the objection is respectfully requested.

Issues Under 35 U.S.C. §112, second paragraph

Claims 2-4 and 6-42 are rejected under 35 U.S.C. §112, second paragraph for being indefinite. Applicants respectfully traverse the rejection.

The Examiner objects to claims 2, 8, 23, 29, 35 and 39 for reciting the word "type". Claims 2 and 13 have been cancelled. With respect to claims 8, 23, 29, 35 and 39, the Examiner will note that these claims have been amended to delete the term "type" therefrom.

In paragraphs numbered as "8" and "9," the Examiner objects to claims 2 and 13, respectively. In view of the cancellation of claims 2 and 13, it is respectfully submitted that the Examiner's objection is rendered moot.

In view of the above amendments and comments, Applicants respectfully submit that the claims particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Accordingly, withdrawal of the rejection is respectfully requested.

Issues Under 35 U.S.C. §102(b) and 103

The following rejections are pending:

- (a) claims 8-11, 13-21, 23-28 and 35-42 are rejected under 35 U.S.C. §102(b) as being anticipated by Marine et al. (U.S. 4,295,148); and

(b) claims 2-4, 6-7, 12 and 29-34 are rejected under 35 U.S.C.

§103(a) as being unpatentable over Marine et al.

Applicants respectfully traverse each of the rejections.

Applicants now respond to the rejection by addressing each independent claim and their respective dependent claims individually.

Claims 2-4, 6 and 7

Applicants respectfully submit that the rejection of claims 2-4, 6 and 7 is rendered moot in view of the cancellation of these claims.

Claims 8-22

The Examiner will note that claim 8 has been amended to recite that the diffusion source includes at least one of silicon and carbon and comprises at least one of Cl, Br, I or alloy thereof.

With respect to the material used as the diffusion source, Marine et al. teach the following:

Aluminum is employed in the example herein described but it should be noted that aluminum could be replaced by indium, magnesium or even by gold in some instances. It has also been observed that a compensated region is formed by means of indium oxide which could be replaced by stannic oxide if necessary. (See column 3, lines 61-66).

As the MPEP directs, all claim limitations must be taught or suggested by the prior art to establish a *prima facie* case of anticipation or obviousness. See MPEP §2131 and §2143.03.

As noted in the above-cited section of Marine et al., Marine et al. use in the examples aluminum as the diffusion source. Since Marine et al. fail to teach or fairly suggest that the aluminum diffusion source could either: a) include; or b) be replaced with at least one of silicon and carbon and comprises at least one of Cl, Br, I or alloy thereof, a *prima facie* case of anticipation or obviousness cannot be said to exist. Accordingly, claims 8-11, 14 and 16-22 are patentable over Marine et al.

Claims 23-26 and 28

As the Examiner will note, Applicants have amended claim 23 to recite that the front surface of the substrate is chemically etched before deposition of the diffusion source. Applicants note that in the paragraph numbered as "25" on page 6 of the outstanding Office Action, the Examiner indicates that Marine et al. disclose this feature at column 2, lines 13-15.

Applicants respectfully submit that the Examiner has mischaracterized the disclosure of Marine et al. For the Examiner's convenience, the passage from column 2, lines 1-15 of Marine et al. is now reproduced.

In accordance with this preferred mode of execution, the material which serves to form the conductive layer is selected from the group of materials which produce compensation of ZnTe after diffusion such as, for example, aluminum, indium, gold, magnesium, indium oxide, stannic oxide. Another preferable feature lies in the fact that said material is of aluminum or of indium oxide.

It is also preferable to ensure that the depth x_j of the compensated layer is substantially equal to the depth of the insulating zone formed by ion implantation or in other words that, substantially, $x_j = x_1 + x_2$. In the event that the conductive material employed is opaque (as is the case with aluminum, for example), it will clearly be necessary to etch said material so as to form a transparent grid.

Marine et al. are teaching the use of a ZnTe substrate upon which is deposited a "conductive material" as the diffusion source. Marine et al. teach that if the conductive material is opaque, such as in the case of aluminum, it will be necessary to etch "said material" so as to form a transparent grid. Thus, it is clear that Marine et al. are teaching that the etching step occurs after the aluminum has been deposited upon the ZnTe substrate and not before deposition of the aluminum on the substrate as asserted by the Examiner. Accordingly, Applicants respectfully submit that claims 23-26 and 28 are patentable over Marine et al.

Claims 29-34

As the Examiner will note, inventive independent claim 29 is a method for producing an electro-luminescence device which comprises a step of depositing a diffusion source on a front

surface of the substrate wherein the diffusion source is limited to a film thickness of from 5 nm to 50 nm. On this matter, the present inventors have surprisingly found that when the film thickness of the diffusion source is limited to 5 nm to 50 nm, there are unexpectedly superior properties given to the electro-luminescent device. The present inventors describe this finding in paragraphs [0088]-[0090] which is now reproduced for the Examiner's convenience:

[0088] As a result, it was found that when the film thickness of the deposited diffusion source was 5 to 50nm, the light observed through the Al diffusion source was green light having high light emission intensity and being stable, while when the film thickness of the deposited diffusion source exceeded 50nm, the yellow light became stronger than the green light in the relative intensity, and the light emission intensity lowered as a whole.

[0089] From this findings, the inventors considered that the luminescence center of yellow is due to defects caused by excess Al. That is, the inventors inferred that as the film thickness of the Al diffusion source increases, the concentration of Al diffusing into the ZnTe substrate increases, thereby the defects caused by Al increases in the ZnTe substrate, so that the intensity of the yellow luminescence increases.

[0090] Then, investigations were repeatedly carried out based on the above-described inference. As a result, producing the electro luminescence device having superior light emission characteristics was achieved by limiting properly the film thickness of the diffusion source.

In the paragraphs numbered as "46" and "47" on page 9 of the Office Action, the Examiner indicates that Marine et al. disclose

that "the film thickness of the diffusion source may be varied (col. 5, ln. 14-17)."

Applicants respectfully submit that the Examiner has mischaracterized this disclosure of Marine et al. and now reproduce the disclosure of Marine et al. at column 5, lines 9-20 for the Examiner's convenience.

It should be added that the resistivity resulting from diffusion of aluminum is of the order of 10^7 to 10^9 Ωcm . In comparison, the resistivity of the insulating region formed solely by ion implantation is of the order of 10^4 to 10^6 Ωcm .

It should be observed that, when overdoping of the starting ZnTe material is employed, ion implantation alone would not produce an insulating region of sufficient thickness and would result in a diode which emits a very small quantity of light (very low injection efficiency). In this case it appears necessary to carry out initial compensation in order to permit effective fabrication of an electroluminescent diode.

In the above-reproduced disclosure of Marine et al., Marine et al. refer to a thickness. However, Marine et al. are referring to the thickness of the insulating region which is formed after diffusion of the aluminum and not the thickness of the aluminum as a diffusion source prior to diffusion, as presently claimed.

Applicants respectfully submit that the thickness of the insulating region is controlled by the time in which the materials are maintained at thermal diffusion temperature and Marine et al. have not correlated the thickness of the insulating region to the thickness of the diffusion source prior to heating to the thermal diffusion temperature. Accordingly, the "thickness" discussed at

column 5, lines 14-17 of Marine et al., is unrelated to the thickness of the diffusion source described in inventive claim 29. It is important for the Examiner to note that the present inventors (in paragraph [0089]) have found that the thickness of the diffusion source relates to the concentration of aluminum which diffuses into the substrate. Accordingly, Marine et al. neither explicitly nor implicitly teach the thickness of the diffusion source.

Despite the fact that Marine et al. neither explicitly nor implicitly teach the thickness of the diffusion source, the Examiner has taken the position that it would be obvious to modify the teachings of Marine et al. so as to prepare the diffusion source on the front surface of the substrate in a film thickness of from 5 nm to 50 nm, as presently claimed. As a basis for this determination, the Examiner states that it would be within the routine skill of the artisan and the result of obvious experimentation to make this modification.

Applicants cannot agree with the Examiner that the film thickness of from 5 nm to 50 nm was the result of obvious experimentation, since any such experimentation would not have come from within the teachings of the art *In Re Fay*, 347 F2d 597, (CCPA 1965). Since Marine et al. are completely silent with respect to the thickness of the diffusion source prior to thermal diffusion, the Examiner appears to have ignored the fact that it is Applicants who have discovered that a diffusion source film

thickness of 5 to 50 nm allows for the emission of green light having a high light emission intensity which is stable.

In determining whether or not such experimentation is within the teachings of the art, the Examiner "must be ever alert not to read obviousness into an invention on the basis of the [Applicants'] own statements; that is, we must view the prior art without reading into that art [Applicants'] teachings." In re Sponnoble, 405 F.2d 578, (CCPA 1969).

Accordingly, the feature that the diffusion source film thickness is from 5 nm to 50 nm renders inventive independent claim 29 patentable over the teachings of Marine et al.

Claims 35-38

As the Examiner will note, claim 35 has been amended to recite that the front surface of the substrate is chemically etched before deposition of the diffusion source. Since this limitation is also recited in inventive claim 23, Applicants respectfully submit that the reasons set forth in the section titled "*Claims 23-26 and 28*" given above equally apply to claims 35-38.

Accordingly, significant patentable distinctions exist between claims 35-38 and the teachings of Marine et al.

Claims 39-42

As the Examiner will note, independent claim 39 recites that the depth of the diffusion is 0.3 μm to 2.0 μm from the front surface of the substrate. On this matter, the Examiner cites column 5, lines 60-62 of Marine et al., see the paragraph numbered as "30" on page 6 of the Office Action. Upon review of Marine et al., it appears that the Examiner meant to cite column 2, lines 60-62 and not column 5, lines 60-62, since column 5 lines 60-62 of Marine et al. refer to the depth of light absorption.

Applicants note from column 2, lines 60-62, that Marine et al. indicates that the depth of the "p" layer must be at least 5 μm in "order to ensure efficient luminescence." As such, Applicants respectfully submit that Marine et al. "teach away" from a depth of diffusion of 0.3 - 2.0 μm , as presently claimed.

A reference which leads one of ordinary skill in the art away from the claimed invention cannot render it unpatentably obvious. *Dow Chem. Co. v. American Cyanamid Co.* 816 F2d 617, (CAFC 1987). In determining the scope and content of the prior art, and determining whether the prior art suggested the claimed invention, the references "must be read as a whole and consideration must be given where the references diverge and teach away from the claimed invention." *Akzo N.V. v. United States Int'l Trade Comm'n*, 1 USPQ2d 1241, 1246 (Fed. Cir. 1986); *In re Fine*, 5 USPQ2d 1596, 1598-99 (Fed. Cir. 1988). Known disadvantages in old devices which would naturally discourage the

search for new inventions may be taken into account in determining obviousness. *United States v. Adams*, 383, U.S. 39, 52 (1966).

Accordingly, significant patentable distinctions exist between independent claim 39 and the teachings of Marine et al.

In view of the foregoing, Applicants respectfully submit that Marine et al. fail to teach or fairly suggest the presently claimed invention, and as such, withdrawal of both rejections are respectfully requested.

Information Disclosure Statement (IDS)

On August 3, 2001, Applicants timely filed an IDS. However, the Examiner has not forwarded signed copies of the PTO-1449 form which was enclosed therewith. Accordingly, Applicants respectfully request a copy of the signed PTO-1449 form which was enclosed with the August 3, 2001 IDS.

Conclusion

In view of the above amendments and comments, Applicants respectfully submit that the claims are in condition for allowance. A notice to such effect is earnestly solicited.

If the Examiner has any questions concerning this application, he is requested to contact Garth M. Dahlen, Ph.D.,


Serial No.: 09/890,774

Esq. (#43,575) at the offices of Birch, Stewart, Kolasch & Birch, LLP.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under § 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By  #43575
Marc S. Weiner
Reg. No. 32,181 *fol*

MSW/GMD/gh

P. O. Box 747
Falls Church, VA 22040-0747
(703) 205-8000

Attachement: 1) Sheet 1 of Drawings